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# Developing a Strategic Plan for WPI's Chemical Engineering Department Initiaves in Brazil

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# Developing a Strategic Plan for WPI's Chemical Engineering Department Initiaves in Brazil

A Major Qualifying Project Report

submitted to the Faculty

of the Chemical Engineering Department at

WORCESTER POLYTECHNIC INSTITUTE

In partial fulfillment of the requirements for the

Degree of Bachelor of Science

by

Matheus Da Silva

Date: April 28th 2016

Approved:

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Professor Stephen Kmietek, Major Advisor

*This report represents the work of WPI undergraduate students submitted to the faculty as evidence of completion of a degree requirement. WPI routinely publishes these reports on its website without editorial or peer review. For more information about the projects program at WPI, please see <http://www.wpi.edu/academics/ugradstudies/project-learning.html>*

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# ABSTRACT

Today there is no cohesive strategy to secure a sustainable long-term engagement between WPI and Brazil. In order to develop a strategic plan, over thirty WPI and Brazilian stakeholders were interviewed and ten years of data from IGSD were analyzed. Three areas of impact were identified: Research & Graduate Ed, Industry, and Reputation & Visibility. As result, a multifaceted three-year plan has been designed, a database with strategic contacts in Brazil compiled, and a project management tool developed.

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# INTRODUCTION & BACKGROUND

How can WPI's Chemical Engineering Department develop a long-term and prolific engagement with Brazil? The purpose of this study is to assist the leaders of this initiative by putting forth a 3-year strategic plan for all engagements between Brazilian academia, the private sector and other relevant organizations in the social and public sectors.

## **Why Brazil – Macro Factors**

Brazil is by far the largest economy in Latin America and the 7<sup>th</sup> largest worldwide. In terms of size and population, Brazil detains the 5<sup>th</sup> biggest territory and is also the 5<sup>th</sup> most populous nation. When it comes to academic impact, according to QS Rankings, from the top 15 universities in Latin America 8 are Brazilian. According to US News Rankings, 9 out of the top 15 academic institutions in the region come from Brazil. Brazilian stakeholders now control some of the biggest conglomerates in the consumer goods industry: Anheuser Bush InBev (largest brewery in the world), Heinz, Kraft, Burger King, Tim Hortons.

## **Why WPI – Macro Factors**

WPI's project based approach was first implemented in 1970 by the Institute's faculty. The WPI Plan expanded on WPI's philosophy, expressed in its motto, "Theory and Practice," that is bringing together theory (taught in the lecture halls) and practice (in the shops, labs, off campus), by introducing a project-based curriculum. Throughout the years the program has become widely known and is often regarded as a very successful experience in STEM education in the US. In order to share its 40 years of experience designing, sustaining and improving a project-based curriculum, WPI has recently founded its Center for

Project-based Learning, which every summer hosts a multi-day institute on campus attended by faculty and administrators from universities across the world.

Another important factor is WPI's effort to make a global impact. Nearly 900 of WPI's students take part on off-campus projects every year, slightly less than one quarter of the entire undergraduate student body, over a 100 of which for MQP. The university holds 45 project centers located in 25 countries. From Latin America to Oceania, WPI has set itself as a truly global polytechnic.

### **WPI's Chemical Engineering Department & Brazil**

The Chemical Engineering Department is one of the largest and most diverse at WPI. The research and projects developed at the department span the wine industry to fuel cells. As a result of its faculty's many areas of interest, the Chemical Engineering Dept. has executed projects at a variety sites: chemical plants, worldly renowned labs, oil companies, pharmaceutical companies, the Coast Guard, government agencies, and many others both inside and outside the United States.

Brazil is part of Latin America, one of WPI's three strategic areas of interest for the next three academic years. As of the fall of 2014, there were 44 active Brazilian students on campus pursuing Bachelors, Masters or PhD degree. For the entering class of 2020, 18 students from Brazil have been admitted. In terms of alumni, approximately 20 former students are now based in the Brazil. Apart from the momentum created by a critical mass of students, Brazil would be a strategic partner for the Chemical Engineering Department as it offers unique research and MQP opportunities in the beverage, consumer goods and logistics industries. In the field of renewable energy, more specifically biofuels, Brazil is considered a top player in the World.

Professor Stephen Kmietek advised a pioneer MQP in Brazil the C term of 2016 at AmBev (Latin American subsidiary of AB InBev). Three students took part in a environmental project at one of AmBev's breweries. It is important to leverage the momentum created with this project in order to nurture a rather long-term relationship with AmBev as well as other potential Brazilian companies. For both the macro as well as the factors specific to WPI and the ChE Dept's current context, Brazil presents itself as a strategic partner in Latin America, a country worth investing WPI's efforts in.

### **The Need for a Cohesive Strategy**

WPI's fast paced dynamics makes it challenging for champions (faculty and administrators) to manage and guide new initiatives. This is a multifaceted challenge that not only involves time commitment from the leaders of the project, but also having access to the right people and organizations in Brazil. It is crucial to develop a strategy with well-defined long-term objectives. Last year, under the leadership of President Laurie Leshin, WPI put forth its 3-year strategic plan. As this study was being developed, it became clear that any other suggested strategy resulted from it should be aligned with WPI's current strategic plan.

How can WPI's Chemical Engineering Department develop a long-term and prolific engagement with Brazil? The purpose of this study is to assist the leaders of this initiative by putting forth a 3-year strategic plan for all engagements between Brazilian academia, the private sector and other relevant organizations in the social and public sectors. The initial hypothesis chose three pillars upon which the Department could secure a strategy for a sustainable and prolific engagement between WPI's Chemical Engineering Department and Brazil. The three pillars are: Academic, Industry, Visibility & Reputation.

# METHODOLOGY

In this study there were four methodologies used: focus groups, one-a-one interviews, data mining, and SWOT analysis. In this section is described how each method was used and what type information was acquired in each stage. This study has gathered both qualitative (interviews, focus groups) as well as quantitative data (data mining and analysis).

## **Timeline**

The following timeline depicts in a rather visual manner when each method was used within the development of the project.

## **Interviews**

As it was initially hypothesized that three pillars (Academic, Industry, Visibility & Reputation) would be a strong foundation for this strategy, interviews were designed accordingly. Over 30 interviews were executed with various stakeholders, from students to faculty, from WPI's senior administrators to C-levels in the corporate world. All of the interviews were categorized into one of the three pillars.

### *Research & Graduate Ed*

For this set of interviews, WPI as well as Brazilian professors, grad students, deans, department heads, and provosts were interviewed. The main purpose of the questions asked was to identify how WPI could become the school of choice for more Brazilian students interested in pursuing a Masters or PhD in Chemical Engineering, what sources of funding would there be for such students as well as to understand potential communication streams for WPI to market itself in Brazil. Some samples questions included:

- What do you find unique about WPI?



- Which Brazilian schools should WPI target when it comes to executing MOUs and developing partnerships? Do you think more universities in Brazil would be interested in sending students for their PhD at WPI?

### *Industry*

Corporate partners play an important role in WPI's project based curriculum. The goals with these interviews were to identify the business value proposition of an MQP to a company (specially within the context of Brazil), to understand how WPI leverage industrial connections turning them into project centers, and identify what are the key elements that secure a sustainable industrial project center in the long-run. For this section were interviewed administrators at the Interdisciplinary and Global Studies Division (IGSD) as well as at the Career and Development Center (CDC). Executives from Brazilian companies and professors who have successfully established industrial Project Centers have also been interviewed. Some samples questions included:

- What makes an industrial MQP a great one?
- What do you perceive as the biggest challenge in order to host a team of students?
- Would your company perceive the value of hosting an MQP?

### *Visibility and Reputation*

Lastly a group of interviews was related to how could WPI build a stronger notoriety in Brazil. Administrators from WPI's Advancement, Admissions, Marketing & Communications, and Provost offices were interviewed. The executive director of Harvard's David Rockefeller Center for Latin American Studies as well as the executive director of Fundação Estudar (founded by Brazil's wealthiest individual, Jorge Paulo Lemann, it is an organization that provides highly selective scholarships to Brazilian students) also took part in the study.

This is a multifaceted pillar bringing many initiatives together. In this category are initiatives such as strengthening alumni bases in the country, assisting admissions efforts to attract prospective students, and connecting WPI with strategic foundations and organizations in Brazil. Some samples questions included:

- What's WPI's marketing strategy in Latin America when it comes to building our reputation down there?
- How can we use alumni chapters strategically for setting up MQPs in Brazil?
- Do we have communication streams in the region that we can use to market our projects/ programs?

### **Focus Groups**

#### *AmBev MQP*

A focus group with the students that participated in the Chemical Engineering Department's first MQP in Brazil was coordinated. Lasting one hour, the main objectives of the activity was to understand what was the overall rating of the students for the project, what were the challenging factors, and what should be improved for potential new projects in the next academic years. Some samples questions included:

- What is your overall impression of the project?
- What were the biggest challenges?
- Do you think AmBev employees bought into the project?
- What do you wish you had known before arriving on the site?

#### *Brazilian Professors*

Professors from UNICAMP (Universidade Estadual de Campinas) and UPE (Universidade de Pernambuco) were also part of a focus group. The two professors had already visited WPI and they knew the Institute fairly well. The main goal with this focus group was to understand, in their opinion, what sets WPI apart from other STEM schools in the United States, what kind of partnerships would they envision between WPI and Brazilian academic institutions, and finally what sources of funding could future partnerships have. Some sample questions included:

- For local students who want to get a graduate degree abroad, what sources of funding are there?
- What projects are you currently running with the private sector?
- What do you find unique about WPI and why do you think Brazilian universities would be interested in partnering with us?

### **Data Mining and Analysis**

Ten years of data on MQPs were mined from the records of WPI's Interdisciplinary and Global Studies Division (IGSD). A table showcasing the distribution of students across all project centers in the past decade was built. From there, it was possible to analyze fluctuations in the flow of students, look for trends in successful, long-term, sustainable project centers as well as infer why some of the project centers were discontinued.

### **SWOT Analysis**

Upon gathering all of the data from the sources stated above, a SWOT analysis was performed in order to assess the international MQP's strengths, weaknesses, opportunities and threats. A benchmark with successful off-campus Project Centers was also developed as part of the SWOT analysis.

# RESULTS

In this section results will be showcased.

## **Interviews**

Gathering qualitative data has represented a significant part of this study.

Over 40 hours of interviews have been recorded.

### *Research & Graduate Ed*

The interviews in this set helps one understand how could WPI's Chemical Engineering Department strategically set itself among the schools of choice for Brazilians that wish to pursue graduate studies in the United States. Three main takeaways were learned:

- I.    Application Process: For PhD students it is more than large scale, what really matters is a good fit with the school. The university can support it, but it is primarily a faculty relationship that needs to be built. Differences between public and private Brazilian universities must also be taken into account. For instance, MOUs have a much greater impact in smaller private institutions than in large public ones. In the second scenario, faculty relationship is even more important. Smaller universities appear to be easier to set a “university-wide” partnership with.
- II.   Funding & Support: Current sources of funding or support for Brazilian students who are currently pursuing their graduate studies in the United States: Fullbright, Academic and Professional Programs for the Americas (LASPAU), Brazilian Mobility Program.
- III.   Communication: by interviewing current Brazilian graduate students at WPI, it became apparent that students came across WPI by chance. Since the Brazilian government funds the majority of the students, the

application process to be granted with a scholarship is tedious, convoluted, and bureaucratic. Communication between most American universities and government agencies is poor. “I was very lucky that Prof. Timko was familiar with the Brazilian Mobility Program,” said Patricia Guerra, PhD student at WPI.

### *Industry*

There are two basic models for industrial MQPs. Firstly, a project sponsored by a company but the project itself takes place on campus. Secondly, a project is sponsored by a company and also takes place at the company site. From the Industry set, there were 3 main takeaways:

- I. Features of a great industrial MQP:
  - a. Commitment not at the highest level of the organization, but from mentors that will work with students on a daily basis.
  - b. Company would ideally support the project financially: 20, 25 or even 30K/ project.
  - c. Very important for the company to understand that these are not interns. An MQP is first and foremost an educational experience. The advisor must play an important.
  - d. Conditions for safe, affordable, appropriate housing and transportation.
  - e. The center director: logistics, finance, admin, etc. Not necessarily the advisor. The person needs to be excited to run the program for years and years to come.
- II. Potential improvements: companies have mentioned that simplifying the bureaucratic process to host a project would make a big impact on how receptive they are to receive student groups.
- III. Using MQPs more strategically: Sponsors have several interests: some want to get the job done (consulting), some are interested in hiring

students. Heard from executives as well as WPI administrators. We still leave it up to sponsors and students to connect. It should be more of an explicit effort.

### *Visibility and Reputation*

- I. Marketing, communication and strategic connections: it lacks a cohesive and comprehensive material explaining to prospective sponsors what an MQP is. “Admissions is the sales arm of the university.”
- II. Admissions: The team has shrunk, and only two people are there at the moment. It has been tried a couple of strategies in Latin America in the past three years. From College Fair Education USA, an event in Brazil attended by 5,000 students to large group travels visiting international schools. Small groups trips however is the most effective and least expensive to reach to Brazilian prospective students. Gompei on the go: strategy where students pick up WPI info packages and take home over break. Finally, it was mentioned that WPI has a modest budget for international admissions, about half of other peer schools, which is reflected on WPI’s very generous scholarships for international students. Out of the box initiatives such as *phonathon*, when current students call admitted students before they make their decision, and as well as online info sessions/ webinars.
- III. Alumni: Brazil has a somewhat strong alumni base. Alumni are crucial when trying to find sponsors for MPQs “They all start with alumni contact. The alumni office provided him with all the alumni living in a certain zip code,” stated Professor David Finkel. He pitched projects himself. Sales is an important part of the job of being the center director. Once projects were finished we had an alumni event to showcase what the students have accomplished.

## **Focus Groups**

Two focus groups have been organized.

### *AmBev MQP*

- I. Communication: by far the most talked topic for improvement. “English was a problem, but the cultural barriers and aligning expectations were the biggest challenge,” said one of the students. “Had WPI explained what an MQP was, the experience would have been completely different,” mentioned another one. In other interviews, it had been mentioned that commitment from the company is needed, but not necessarily from top executives. The people who will be working directly with the students will need to be onboard with the project and see the value of it.
- II. Selection process: students felt highly trusted by AmBev. It was stressed that profile of students selected for this (or a similar) project center is of someone independent, reliable and with project experience. It could become an issue if a group of students demand continuous micro-management.

### *Brazilian Professors*

Professors from Unicamp and UPE took part in the session. Three key-points can be taken from what was discussed in the focus group meeting:

- I. Real Interest: both institutions, Universidade Estadual de Campinas (UNICAMP) and Universidade de Pernambuco (UPE), have submitted MOUs that are already in the process of being signed. On WPI’s end, the Chemical Engineering Department is leading both MOUs.
- II. Community: both professors felt incredibly welcome when they visited WPI. By comparing with similar visits to other schools in the United States

and Europe, it was said that the reception from WPI faculty and students had been unprecedented.

- III. **Project-based Curriculum and Connectivity:** Brazilian universities tend to focus on theory and less so on practice. It was unanimously said that WPI's curriculum is definitely a very interesting comparative advantage (including other US-based potential partners). Location was also mentioned more than once. Worcester is a privileged region for its proximity to the greater Boston area. Moreover, it was highlighted that WPI's faculty is well connected with other professors across the greater Boston area.

### **Data Mining and Analysis**

10 years of data were collected from the Interdisciplinary and Global Studies Division (IGSD). The data was analyzed in two stages: first students were distributed by year and project center; secondly data was analyzed in order to spot trends in the flow of students per project center along the years.

The three main takeaways from the data were:

1. In the 2005/2006 academic year only 14 Project Centers hosted an off-campus MQP (minimum) and in the 2012/2013 academic year there were a total of 21 Centers involved. However, despite the discrepancy between the two years, in the past decade WPI has not increased the total number of off-campus Project Centers hosting MQPs. The number is usually oscillating between 17 and 19 Project Centers, with an average of 17.2 Centers in the past ten years.
2. Comparing the two ends of the spectrum, only three project centers have remained active in the past ten years: MIT Lincoln Labs, Silicon Valley and Wall Street. For their impressive and sustained track record, the directors of both Silicon Valley (David Finkel) as well as Wall Street (Kevin



Sweeney) Project Centers were interviewed for the qualitative part of this study.

3. In the past ten years, Wuhan Project Center (in China) has hosted the 3rd largest number of projects, a total of 110. Nonetheless, for the past three years it has become inactive. This shows that even Project Centers with an impressive record is susceptible to external factors.

## **SWOT Analysis**

This is a simple analysis that assists structuring the problem and identifying potential solutions.

### *Strengths*

Experience: four decades of project-based curriculum.

### *Weaknesses*

Creating lasting partnerships: in the past ten years, only 3 project centers have remained active. Communication is poor and

The lack of strong financial backbone: WPI does not have a steady revenue stream from MQPs

### *Opportunities*

A model that could work better is a model that is multifaceted: at the same center MQPs, IQPs, internships, and Co-ops could be hosted. A sustainable model is a model that has several revenue streams from the same sponsor. Sponsors should perceive WPI as a year-round service provider, not a 1-time thing during the year. Most of the project centers nowadays are more of a one-size-fits-all kind of operation. Diversifying the offers to a few sponsors is better than having a lot of sponsors with a few projects.

The project center could have an executive advisory board: they meet twice a year formally, keeps everyone informed. Faculty, WPI administrators, executives from the corporate sector, and alumni could be part of the executive board.

### *Threats*

Two clear objectives for a company to host an MQP team are: 1) recruiting (when they retain the students that have developed their MQP at the company) or 2) consulting/ performance based (the results brought in by the students are so outstanding that it justifies the investment made by the company). If companies start to feel as if neither of those goals has been successfully achieved, they might no longer host projects.

# DELIVERABLES & RECOMMENDATIONS

In this section, four tangible deliverables will be shared: the three-year strategic plan; a database with contacts in Academia, Industry, and other strategic contacts; an agenda for strategic engagement to take place in the Fall of 2016; and a project management tool to assist faculty champions in the implementation stage.

## **Three-year strategic plan**

Being able to develop a strategy that will leverage WPI's strengths was the key driver for the study. This three-year plan will guide the Chemical Engineering Department when it comes to any engagement with Brazil.

### *Research & Graduate Ed*

The purpose of this pillar is to develop strong connections with top academic institutions in Brazil and to attract PhD and Masters students. The three-year goals are: to execute one MOU, to have at least 3 PhD students and 3 Masters students, to close partnerships with faculty at target schools (such as UPE, ITA, UNICAMP, USP). Prof. Michael Timko would lead this pillar.

### *Industry*

The goal of this front is to solidify and expand partnerships with Brazilian and leading companies. The three-year goals are: 6 MQPs in Brazil with 3 different companies, at least 18 UG students have projects in Brazil with target companies (such as AmBev, Kraft-Heinz, and Hidrovias do Brasil). Prof. Stephen Kmietek would lead this pillar.

## *Reputation & Visibility*

The aim of this structure is to establish WPI and the Chemical Engineering Department as a global leader in project-based education. The three year goals are: connections with Estudar and Lemann Foundations, assist Admissions office potentially recruiting future ChE majors and PhD's/ Masters, showcase the impact of our projects in Brazil to local alumni, press and on campus. Prof. David DiBiasio would lead this pillar.



## **Database**

A database with contacts in Academia, Industry and other strategic organization has been created. The database will be shared with all WPI stakeholders and faculty champions.

## **Agenda for strategic engagement in the Fall of 2016**

This pioneer engagement will be the cornerstone for achieving long-lasting impact through WPI's future initiatives in Brazil. The trip would last 6 days,

taking place in September after Rio 2016 Summer Olympics and the beginning of class at WPI. Potential KPI's to measure impact of engagement

	DAY1: Sun ARRIVAL	DAY2: Mon SAO PAULO	DAY3: Tue SAO PAULO	DAY4: Wed SAO PAULO	DAY5: Thu SAO PAULO	DAY6: Fri S. J. CAMPOS
<b>A</b> <i>Research Grad Ed</i>	- Arrival in Sao Paulo (GRU airport) on Sunday	- Event: Center for Project Based Learning (C)  - Visit: <u>Fundação Estudar</u> (A) – Denis Mizne	- Visit <u>Inspier</u> (A)  - Visit Harvard Office – Vinicius Licks (A, C)  - Visit <u>AmBev</u> (B)	- Execute MOU with leading Brazilian university – UNICAMP (A)  - Visit <u>Hidroviás do Brasil</u> (B)  - Brazil's Alumni Reunion	- WPI Admissions Info Session (C)  - Visit USP – meet Provost and Dean of Engineering school(A)  - Visit Kraft Heinz (b)	- Visit General Motors and Sam Russel (B)  - Visit ITA (A)  - Visit Embraer and its COO Helio Bambini (B)  - DEPARTURE: Saturday
<b>B</b> <i>Industry</i>	- Alumni dinner: Samuel Russel, Alessandro Chicarelli and Gunther Schrappe (C)	- Visit: <u>Fundação Lemann</u> (A) – Tiago Mitraud	- Visit <u>Votorantim Cimentos</u> (B)			
<b>C</b> <i>Rep. &amp; Visibility</i>						

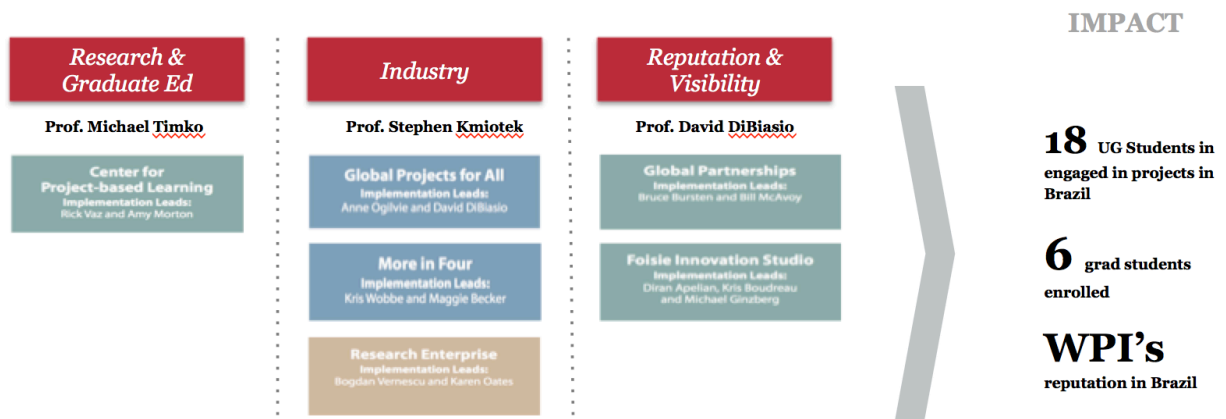
PMO: Management tool

Just as important as a solid strategy is the implementation, a management tool has been built in order to keep track of the progress being made.

Brazil/ ChE Dept - PMO							
File Edit View Insert Format Data Tools Add-ons Help All changes saved in Drive							
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	A	B	C	D	E	F	G
1		STRATEGIC PLANNING					
2				Strategy	Deadline	Who	Status
3				Tactics:			
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18				Operation:			
19				Operation:			
20				Tactics:			
21				Operation:			
22				Operation:			
23				Operation:			
24				Operation:			
25				Operation:			
26				Strategy	Deadline	Who	Status
27				Tactics:			
28				Operation:			
29				Operation:			
30				Operation:			

## Alignment with WPI's Elevate Impact Strategic Plan

Apart from its Key-Stakeholders, this plan for Initiatives in Brazil leverages Synergies across WPI's three-year Strategic Plan. The Research & Graduate Ed pillar leverages synergies with



## Recommendations that go beyond this project

Here there is a list of recommendations that could be implement with relative ease in the short and mid-term.

### *Legal & Logistics*

- Simplifying the legal process to host an MQP: a few companies have mentioned that the legal/ logistical process is long and convoluted. One company even mentioned that this could become a roadblock for the company to host future projects. They said that they did not expect
- Making a one pager with the most asked legal questions such as: Cost. The types of work. They want to understand where they stand when it comes to IP. They get to retain the rights. Then they want to understand logistics: are they here full-time, part-time. I like to think of it as a consulting relationship. Finally, they want to understand their academic obligations. How are they supposed to cooperate with us?

### *Marketing & Communications*

- Creating a “non-tangible” check list before hosting any project off-campus: do we have all of the key components for a successful project
- Creating a one-pager to explain what an MQP is and make it widely distributed
- From interviewing graduate students, it became clear that mentioning “Brazilian Mobility Program” or posting the Brazilian flag on the Department’s webpage. It would benefit the Department if it could very clearly let students know that WPI has partnered with the program and is familiarized with the process. This genuinely seems like a low hanging fruit that could substantially increase the number of applications to WPI.

#### *Administrative*

- Incentives program for professors
- Panel sharing best practices: David Finkel (Silicon Valley), Kevin Sweeney (Wall Street), Stephen Kmietek (Galo & Nancy)

# REFERENCES

1. Interviews with several stakeholders
2. Focus groups
3. IGSD data, 2003/2004 – 2015/2016

WPI's Elevate Impact Strategic Plan 2015-2018



# APPENDIX

1. Notes from Interviews with several stakeholders
2. Notes from focus groups
3. IGSD data, 2003/2004 – 2015/2016
4. 3-Year Strategic Plan
5. Agenda for Strategic Engagement